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EFFICACY OF DIFFERENT FUNGICIDES AGAINST RICE BLAST UNDER FIELD CONDITION IN RICE CROP

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Rice blast *Pyricularia oryzae* Cav. has bad effect on rice and decreases its yield every year. Present investigation was aimed to evaluate the comparative efficacy of different fungicides for blast management in rice crop under agro-climatic conditions of Pakistan. This experiment was conducted following the randomized complete block design (RCBD) with three replications. Five fungicides were used for blast management in rice crop. The fungicides viz., Recado 32.5% SC @ 200 ml/acre, Thrill 20% WP @ 250 g per acre, Nativo 75% WP @ 65 g/acre, Recado Ultra 40% SC @ 200 ml/acre and Amistar Top 325 SC @ 200 ml/Acre. For each treatment, there were three replications. The significantly affected parameters were percent disease intensity (PDI), plant height (cm), number of tillers (m^{-2}), number of grains (m^{-2}) and grain yield (kg ha^{-1}). The results showed that maximum yield was recorded for Nativo 75% WP whereas minimum yield was for control plot. The fungicide Nativo 75% WP @65 g a.i. per acre was applied at performed well and exhibited effectively blast control and better yield in rice**.** Minimum percent disease intensity (11.16%) was observed in treatment of Nativo 75% WP whereas maximum (58.50%) percent disease intensity was in control treatment. Maximum plant height (88.83 cm) was recorded for Nativo 75% WP. Similarly, maximum number of tillers recorded for Nativo 75% WP were 164 m^{-2}. The maximum value of grain yields of 4403.32 kg ha^{-1} was observed in Nativo 75% WP treated plots followed by Amistar Top 325 SC.
Keywords: Fungicides, rice, efficacy, azoxystrobin, teboconazole, trifloxystrobin, pyricularia oryzae.

INTRODUCTION

Rice (*Oryza sativa* L.) is the main cereal grain crop in the globe. It is the staple food of people of Pakistan after wheat. Its contribution is 3% to the value added in agriculture and to GDP is 0.6%. During 2018-19, it was grown on an area of 2810 thousand hectare with an annual production of 7202 thousand tons (Anonymous, 2018-19) which is far below the yield level obtained in other rice growing countries of the world. Every effort is being made to meet the rice requirements of the country. There are many reasons for low yield of rice crop, but disease incidence is the basic and major component of low yield in crop production system. With the advent of new short stature varieties, disease has become even more severe.

The fungus *Pyricularia oryzae* attacks at all stages of the crop and symptoms appear on leaves and nodes (Seebold *et al.*, 2004). *M. oryzae* in rice brings forth typical disease symptoms such as leaf blast, nodal blast, neck blast or panicle blast. Compared to leaf blast, neck blast causes highest yield loss since it affects the panicle directly. An area with high rainfall and cooler climate are sternly affected (Ghatak *et al.,* 2013). Heavy yield losses have been reported in many rice growing countries. For example, 75, 50 and 40 percent grain loss may occur in India (Padmanabhan, 1965), Philippines (Ou, 1985) and Nigeria (Awodera and Esuruoso, 1975). Blast epidemics happened across various rice growing countries including Korea, Vietnam, India, China, and United States to the extent of 50% yield loss (Wilson and Talbot, 2009). In Pakistan during the last two decades, rice blast *Pyricularia oryzae* is mostly found in districts of Faisalabad, Toba Tek Singh, Vehari and place like Gaggoo Mandi (Arshad *et al.,* 2008).

The most usual approaches for the management of rice blast *Pyricularia oryzae* include manipulation of planting times, planting of resistant cultivars, and application of fungicides, fertilizers and irrigations (Georgopoulos and Ziogas, 1992; Moletti, 1988; Mbodi *et al.*, 1987; Naidu and Reddy, 1989). However, most of these resistant varieties are short-lived and the resistance is broken down due to variable nature of fungal pathogen. In addition, the fungus also gains fungicide resistance by mutating the target genes of fungicides (Kim *et al.*, 2003). Among the methods, fungicidal control is largely practiced for blast disease in many temperate or subtropical rice growing countries, primarily in Japan, China, South Korea, Taiwan and Vietnam (Kumar *et al.,* 2014). Present investigation reports on the effect of various fungicides on the management of rice blast *Pyricularia oryzae* and their impact on rice yield under the agro climatic condition of Pakistan.

MATERIALS AND METHODS

The experiment was conducted during kharif season 2019 at Agricultural Farm, Chak Dhermewala, Tehsil Depalpur, District Okara. Rice nursery of Kisan Basmati (1509) was sown in the month of May. The healthy seeds were placed in the form of heaps on the Gunny bags and water was sprayed on the seeds with help of sprinkler, so that seed may get germinated for sowing after 2 days. The land was prepared by puddling method by applying one ploughing followed by two ploughing after one week. The plot size for each treatment was 2 × 6 meters with eight rows in each plot and plant to plant and row to row distance was 25 cm. Fertilizer was applied @ 100, 50 0 Kg of NPK and Ferteera was used as insecticides @ 4 Kg/acre and weeds were controlled by as Sunstar gold 60 WG @ 20 g/acre. The experiment was laid in RCBD with three replications and the fungicides were applied at the recommended rates of manufactures (Table 1). Three applications of fungicides at weekly interval were given, the first at booting stage. The data regarding the occurrence of the blast disease was recorded one week after the last application of fungicides by using the disease rating scale of 0-9 developed by International Rice Research Institute (IRRI, 1996) and then converting into percent disease by using the formulas.

$$\text{Disease \%} = \frac{\text{Average of the disease score X 100}}{9}$$

or

$$\text{Disease \%} = \frac{\text{Sum of the scores x 100}}{\text{No. of observation x highest no. in rating scale}}$$

The data on the yield were recorded by marking 3 × 2 m section with-in each plot using a wire frame as described by Seebold *et al.* (2004) and tillers with-in the frame were cut and harvested in order to determine the yield.

Table 1. Different fungicides used for blast management in rice crop during 2019.

Fungicides (Trade name)	Common Names	Dose rates used
Recado 32.5% SC	Azoxystrobin + Difenoconazole	200 ml/Acre
Thrill 20% WP	Bismenthazole	250 g/acre
Nativo 75% WP	Teboconazole + Trifloxystrobin	65 g/acre
Recado Ultra 40% SC	Azoxystrobin + Teboconazole	200 ml/acre
Amistar Top 325 SC	Azoxystrobin + Difenoconazole	200 ml/acre
Control	-	-

Statistical analysis: Data from each experiment were subjected to analysis of variance (ANOVA) by using Duncan's Multiple Range-Test (DMRT) at 5% significance (Gomez and Gomez, 1984).

RESULTS

The data recorded on percent disease intensity, number of tillers (m^{-2}), plant height (cm) and grain yield (kg ha^{-1}) were significantly affected by the different fungicide treatments. The results for the studied traits are presented as under:

***Percent disease intensity (PDI)*:** The results of field experiment showed that, there was a significant difference among the treatments with respect to PDI of rice blast and all the treatments recorded significantly lower per cent disease intensity and higher yield compared to untreated control plots (Table 2). The treatment in which fungicide Nativo 75% WP were applied showed the best results with minimum per cent disease intensity (11.16%) followed by treatment in which fungicide Amistor top 325 SC 12.55%, were applied.

Table 2. Comparative percent disease intensity (PDI) using different fungicides in rice crop in district Okara.

Fungicides	Percent Disease Intensity (PDI)
Recado 32.5% SC	17.85
Thrill 20% WP	18.73
Nativo 75% WP	11.16
Recado Ultra 40% SC	16.87
Amistar Top 325 SC	12.55
Control	58.50
LSD value at 5% @ level	

***Plant height (cm)*:** Different fungicide significantly affected the plant height cm (Table 3). Statistical analysis showed that maximum plant height (cm) was recorded for Nativo 75% WP while the minimum plant height (cm) was recorded in treated plot.

***Number of tillers (m^{-2})*:** Different fungicides significantly affected the number of tillers m^{-2} (Table 3). Statistical analysis showed that maximum number of tillers m^{-2} was recorded for Nativo 75% WP while the minimum number of tillers m^{-2} was recorded in treated plant.

Table 3. Plant height cm and Number of tillers m^{-2} as affected by different fungicides in rice crop in district Okara.

Fungicides	N. of productive tillers m^{-2}	Plant height (cm)
Recado 32.5% SC	159.03	88.00
Thrill 20% WP	160.33	88.00
Nativo 75% WP	164.00	88.83
Recado Ultra 40% SC	161.00	88.25
Amistar Top 325 SC	156.33	88.42
Control	154.00	84.67
LSD value at 5% @ level.		

***Grain yield ($kg \cdot ha^{-1}$)*:** All fungicide for rice blast management significantly affected the grain yield (Table 4). The maximum value of grain yields of 4403.32 kg

ha^{-1} was observed in Nativo 75% WP treated plots followed by Amistor Top 4305.47 kg ha^{-1}. Minimum value of grain yields of 3553.29 kg·ha^{-1} was observed in treated plots.

Table 4. Grain yield (kg·ha^{-1}) as affected by different fungicide treatments in rice crop in district Okara.

Fungicides	Grain Yield (kg ha^{-1})
Recado 32.5% SC	4134.78
Thrill 20% WP	3835.98
Nativo 75% WP	4403.32
Recado Ultra 40% SC	4214.53
Amistar Top 325 SC	4305.47
Control	3553.29

DISCUSSION

The prosperity of our people depends to a large extent on good rice harvests. Diseases are a major problem and reduce the yield of rice. Rice blast reduce the crop yield, deteriorate the quality of farm produce and hence reduce the market value of rice. Similar results regarding the efficacy of different fungicides has been reported by different scientists throughout the world like Varier *et al.* (1993) used eight fungicide for management of rice blast and seed treatment with tricyclazole @ 4kg/kg seed proved effective after 40 days of sowing. Dubey (1995) conducted field trails of eight fungicides for control of rice blast Topsin M + Indofil M-45 was showed that most effective against *Pyricularia oryze* leaf blast disease of rice. Minami and Ando (1994) reported that probenazole induce a resistant reaction in rice plants against rice blast. Gouramanis (1995) found that fungicides thiophanate methyl, carbendazim, pyroquilon, and chlobenthiazone reduce the rice blast disease of rice on the other hand tricyclazole was effective in reducing the neck blast. Enyinnia (1996) showed that two systemic fungicides Benomyl and Tricylazole on Faro/29, a rice cultivar, at full booting stage and reported good control of natural infection of rice leaf blast. Filippi and Prabhu (1997) showed that broadcast fungicide was effective in controlling leaf and panicle blast. The results are supported by the work of (Narayanswamy *et al.*, 2009) who showed that application of tebuconazole + trifloxystrobin was found most effective in controlling rice blast as it controlled the disease up to the extent of 84 per cent compared to control. Mohan *et al.* (2011) and Nirmalkar *et al.* (2017) reported that tebuconazole + trifloxystrobin and tebuconazole were found most effective against the leaf and neck blast of paddy under field condition. Different scientists confirmed that strobilurin derived fungicides found to be effective in controlling rice blast disease compared to other fungicides (Pramesh *et al.*, 2016; Debashis *et al.*, 2012). Tirmali *et al.* (2001) showed that, the efficacy of new fungicides in controlling rice blast treated with tebuconazole and difenoconazole at maximum tillering, panicle initiation and at heading stage of crop and found that all these new fungicides have significantly reduced the occurrence rice blast disease incidence

***Conclusion*:** Diseases are a major problem and reduce the yield of rice. Diseases reduce the crop yield, deteriorate the quality of farm produce and hence reduce the market value of rice. The efficacy of fungicide, however, depends more upon their formulation in addition to time, methods and rates of application. The results of our study reveals that rice blast can be effectively controlled using new formulation of fungicides. From five fungicides used in study, Nativo 75% WP was most effective in rice blast control. Minimum percent disease intensity (11.16%) was observed in treatment of Nativo 75% WP whereas maximum (58.50%) percent disease intensity was in control treatment. Maximum plant height (88.83 cm) was recorded for Nativo 75% WP. Similarly, maximum number of tillers m^{-2} recorded for Nativo 75% WP were 164.0. The maximum value of grain yields of 4403.32 kg ha^{-1} was observed in Nativo 75% WP treated plots followed by Amistortop 325 sc 4305.47 kg·ha^{-1}.

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